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ELECTRICITY.—*Work of the International Technical Committee on Electrical Units.* E. B. ROSA and F. A. WOLFF.

The International Electrical Conference at London in 1908 adopted specifications for the mercury ohm, the silver voltameter and the Weston Normal Cell, and fixed a provisional value (1.0184 international volts at 20°C.) for the last. The specifications for the mercury ohm and the Weston cell were more or less complete, but for the silver voltameter the specifications were very inadequate, and since the value to be assigned to the Weston cell necessarily depends upon the specifications for the silver voltameter, and the results of different investigators were not in close agreement, the conference selected an approximate value which it adopted as provisional only, until further experiments could be made and more precise values determined.

The Weston normal cell, officially adopted at the London Conference in place of the Clark cell, has had the following values: In America, 1.0189 at 25°, equivalent to 1.0191 volts at 20°; in Germany, 1.0186 volts at 20°; in England, 1.0184 volts at 20°. Some of the other countries have the same value as America, others the same as Germany.

In order that the different countries might coöperate in fixing and maintaining uniform throughout the world the values of the electrical units, the London Conference established an International Committee on Electrical Units and Standards, charged with the duty of promoting investigations in electrical standards and electrical measurements, and of securing the intercomparison of the standards of different countries. This committee represents eleven different countries, there being two members each from America, England, France and Germany, and one

member each from Austria, Italy, Russia, Switzerland, Holland, Belgium and Japan. The president of the committee is Professor Dr. E. Warburg, president of the Physikalisch-Technische Reichsanstalt, Berlin; vice-president, Dr. R. T. Glazebrook, director of the National Physical Laboratory, London; treasurer, Dr. S. W. Stratton, director of the Bureau of Standards, Washington; secretary, Dr. E. B. Rosa, physicist, Bureau of Standards.

It had been suggested at the London Conference of 1908 that delegates from the several national standardizing laboratories might come together under the auspices of the International Committee for coöperative work on standards whenever that seemed necessary, and this was a case where it did seem necessary.

Accordingly, it was suggested to the president and vice-president of the International Committee by Drs. S. W. Stratton and E. B. Rosa jointly in letters dated March 15, 1909, that such an investigation be carried out at Washington, in the laboratories of the Bureau of Standards. This suggestion was adopted and a special committee, known as the International Technical Committee was appointed. This committee assembled at Washington April 4, 1910, under the presidency of Dr. Stratton.

The committee was as follows: Dr. E. B. Rosa, Chairman; Dr. W. Jaeger, Geheimer Reigierungsrat, Mitglied der Physikalisch-Technischen Reichsanstalt; Prof. F. Laporte, Sous Directeur du Laboratoire Central d'Électricité; Mr. F. E. Smith, Principal Assistant, National Physical Laboratory; Dr. F. A. Wolff, Associate Physicist, Bureau of Standards.

The committee unanimously appointed Dr. F. W. Grover secretary for the preparation of the minutes and records.

From April 4 to May 25, 1910, the committee held nineteen meetings, made or had made seventeen series of experiments on the silver voltameter, besides numerous comparisons of resistances, of standard cells and of weights.

The apparatus and installations which were used in carrying out these experiments and these comparisons were those which are in use at the Bureau of Standards, except such of the voltameters, resistances, standard cells, weights and chemical materials as were brought by the delegates.

1. RESISTANCE COMPARISONS

Each delegate brought with him one or more resistance standards with the object of furnishing data on the relative values of the unit of resistance employed in the four laboratories, and of deriving a basis for the voltameter measurements made in Washington. The results obtained also served the further purpose of establishing the magnitude of one of the corrections to be applied to the voltameter measurements previously made by the delegates, to reduce them to a strictly comparative basis.

The necessary electrical comparisons were all made in a thermostatically controlled and well stirred oil bath, the standards being substituted in turn in the same arm of a Kelvin double bridge. The connecting resistance between the standard and an auxiliary 1-ohm coil was so small as to require no adjustments of the auxiliary (10-ohm) bridge arms, the coils under comparison all having approximately the same values, and the resistance of the connections to the auxiliary bridge arms being very low.

The results of the comparisons of the different metallic resistances were as follows:

$$\text{Ohm PTR} - \text{Ohm NBS} = +2 \times 10^{-6}$$
$$\text{Ohm NPL} - \text{Ohm NBS} = +12 \times 10^{-6}$$

From these can be deduced that the differences between the values of the ohms in use in the different laboratories, and as represented by the coils brought to Washington, and the value adopted by the technical committee are as follows:

$$\text{For the PTR ohm} - 5 \times 10^{-6}$$
$$\text{For the NPL ohm} + 5$$
$$\text{For the NBS ohm} - 7$$
$$\text{For the LCE ohm} + 110$$

The relative measurements of the metallic resistances showed that the resistances inclosed in sealed boxes gave, during the experiments in Washington, results more regular than the metallic resistances for which this precaution had not been taken.

The Technical Committee therefore decided to choose, actually and until new mercury ohms shall have been constructed, as the value of the international ohm, to be recommended to all coun-

tries, the mean of the values of the units realized at the Physikalisch-Technische Reichsanstalt and National Physical Laboratory. Altho the international ohm, as defined by the London Conference, has not been strictly realized, the committee believed that its value has been obtained in two independent laboratories, with a good degree of precision, and that future work will not change its value by more than 2 or 3 parts in 100,000.

The committee expressed the hope that new international ohms, fulfilling all the specifications of the London Conference, might be realized as soon as possible in different laboratories.

2. STANDARD CELL COMPARISONS

Each of the delegates brought with him a considerable number of cells, which were repeatedly compared, under the most favorable conditions, with those of the Bureau of Standards, thus furnishing a basis for expressing the results of the voltameter work undertaken at Washington, as well as for further work in the home laboratories. In addition, this made possible the direct comparison of the standards of electromotiveforce employed in the four institutions, and furnished data of value on the accuracy attainable in the reproduction of the Weston Normal Cell. Further data on the last question were obtained from 48 cells set up in Washington, with four samples of mercurous sulphate representing the methods of preparation adopted in the four institutions. Portions of each sample were washed according to the procedure followed in the four laboratories, and three cells were set up with each washed sample. In addition, two cells were set up with each of four samples of cadmium sulphate submitted; comparative tests were also made of four samples of mercury and of cadmium or cadmium amalgam.

The comparisons were made in a basement room especially fitted up for such work, in automatically controlled petroleum baths, each of which was provided with coils for electric heating, a cooling coil for water circulation when operating at temperatures below that of the room, an efficient stirrer and means for directing the circulation in the bath, and a sensitive thermoregulator, in addition to a rack for mounting the cells.

From the point of view of the methods of preparation of the mercurous sulphate, the following differences exist among the cells:

At the PTR, by precipitation by adding hot sulphuric acid to acid mercurous nitrate, or the reverse.

At the NPL, by precipitation by adding mercurous nitrate to sulphuric acid.

At the NBS, by electrolysis with direct current.

At the LCE, part by electrolysis with direct current, the rest by alternating current electrolysis.

All the cells were compared several times during the work of the delegates. As a result of these comparisons, the technical committee decided to choose as "value of the *Weston Normal Cell*, the mean value of the cells submitted by the delegates of the four laboratories. This mean has been calculated in the following manner: The mean of the values of the standard cells, presented by each delegate, has first been taken, and then the mean of the four numbers thus found."

DIFFERENCES IN MICROVOLTS BETWEEN SEPARATE GROUP MEANS AND THE BUREAU OF STANDARDS BASIS OF REFERENCE

Group Mean—NBS Basis of Reference

NUMBER OF CELLS	APRIL 7	APRIL 8	APRIL 11	APRIL 15	APRIL 22	APRIL 29	MAY 10	MAY 16	MEANS	MEANS MINUS GROUP MEAN	AVERAGE DEVIATION OF INDIVIDUAL CELLS FROM SEPARATE GROUP MEANS
PTR 15..	+26	+27	+27	+26	+27	+26	+25	+25	+26	0	±10
NPL 34..	+22	+25	+26	+25	+25	+25	+24	+23	+24	−2	± 9
LCE 15..	+35	+38	+37	+35	+34	+34	+32	+35	+35	+9	±25
NBS 40..	+17	+18	+19	+18	+18	+17	+16	+16	+17	−9	± 6
Mean of group means	+25	+27	+27	+26	+26	+26	+24	+25	+26		

The cell (no. 109) used in making the voltameter measurements, was frequently compared with the original reference cells

of the Bureau of Standards and its value in terms of the mean of the group means was thus known. The cells set up by members of the Committee in Washington confirmed in the main the conclusions derived from the cells brought from the home laboratories, although considerably larger differences than shown in the above table were found.

3. DESCRIPTION OF THE EXPERIMENTS ON THE VOLTAMETER

The current in the voltameter circuit was held at such a value that the drop of potential over the 2-ohm resistance standard was equal to the electromotive force of the standard cell used. To correct, however, for errors in the potentiometer, such as errors in the adjustment of the relative values of the coils, thermo-electromotive forces, changes in the potentiometer current and the like, a control circuit was arranged. Cell no. 109 whose value was to be determined by means of the voltameters, was joined in series with a sensitive galvanometer, so that by depressing a key the drop of potential over the standard resistance could be opposed directly to that of the standard cell. This circuit served as the ultimate control for the current. The procedure adopted was as follows: While one observer adjusted the current until the electromotive forces in the circuit just described were balanced, a second observer at the potentiometer took note of the resting place of the potentiometer galvanometer which corresponded to this balance. The reading of the potentiometer galvanometer was then held at this point, by means of the Kelvin rheostat, with an occasional check on the correct resting point by the method just described. This procedure not only allowed the errors of the potentiometer to be eliminated, but permitted a second observer to judge of the steadiness of the current at the same time.

The duration of each experiment was timed by a chronograph recording the ticks of a standard Riefler clock.

The deposits were weighed in a constant temperature room constructed especially for the purpose and a high order of accuracy was obtained.

In all the experiments with the silver voltameter, the strength of the current was maintained constant at the value of approximately 0.5 ampere, the length of time of its passage being two hours, and the weight of silver deposit being slightly greater than 4 grams.

The delegates originally employed the silver nitrate and the voltameters which they brought with them and carried out the work under experimental conditions similar to those used by them ordinarily in their respective laboratories.

In the greater part of the experiments Dr. Jaeger used a form of voltameter employing silk and a glass cup, to separate the anode from the cathode.

Mr. Smith employed the arrangement designated by him by the name of "the new form."

Dr. Rosa made use ordinarily of the porous pot of porcelain.

M. Laporte employed the filter paper form.

In some of the experiments, certain of the delegates exchanged materials and used the apparatus of one another.

While the delegates carried out their experiments, members of the Bureau of Standards, under the direction of a subcommittee, made other experiments on the silver voltameter, with the end in view of studying the different electrolytes and forms of voltameter used.

SUMMARY OF RESULTS OF 89 DEPOSITS, EXCLUDING RELATIVE VALUES OF EXPERIMENTS 1, 14, AND 16

1. With Voltameters Using Porous Cups or without any Septum (with Electrolyte neutral by the iod-eosine test and free from reducing substances by the permanganate test)

(1) Mean of 10[1] deposits, NPL, new form voltameter	1.01831_1
(2) Mean of 4 deposits, NBS, porous cup, large voltameter	28_9
(3) Mean of 9 deposits, NBS, porous cup, small voltameter	28_5
(4) Mean of 1 deposit, NBS, porous cup, medium voltameter	28_8
Mean 24 deposits, two types, several sizes of voltameters	1.01829_7
Mean excluding two determinations with unsteady current	1.01828_6

[1] Two deposits in NPL, new form, in seventh experiment, gave 1.01841_8. The current in this experiment was unusually unsteady. If these two determinations be excluded, the mean of 8 deposits is 1.01828_7 and the mean of 22 is 1.01828_6.

2. Using Filter Paper

(6) Mean of 3 deposits, PTR, with filter paper	1.01846$_9$
(8) Mean of 6 deposits, LCE, with filter paper	43$_7$
(15) Mean of 1 deposit, NPL, with filter paper	47$_5$
Mean of 10 deposits	1.01845$_0$

3 Using Silk

(5) Me n of 6 deposits, PTR, with silk	1.01828$_2$
(14) Mean of 2 deposits, NBS, with new silk	58$_0$
(13) Mean of 6 deposits, NBS, with used silk	28$_5$
(17) Mean of 1 deposit, NPL, with used silk (electrolyte slightly alkaline)	29$_0$
Mean of 15 deposits	1.01832$_3$
Mean of 13 deposits, excluding new silk	1.01828$_6$

4. Electrolyte Indicated by the Chemical Tests to be Slightly Impure

(7) Mean of 1 deposit, PTR, with no septum	1.01837$_3$
(9) Mean of 2 deposits, LCE, with no septum	22$_1$
(16) Mean of 2 deposits, NPL electrolyte, with no septum, large voltameter	45$_9$
(11) Mean of 11 deposits, NBS electrolyte, with porous cups, large voltameter	43$_0$
(12) Mean of 18 deposits, NBS electrolyte, with porous cups, small voltameter	28$_0$
(10) Mean of 1 deposit, LCE electrolyte, with porous cups, medium voltameter	21$_4$
Mean of 35 deposits	1.01833$_8$

5. Electrolyte Slightly Alkaline—NaOH *added*

(18) Mean of 2 deposits, electrolyte, alkaline, added $2.1/10^6$ NaOH	1.01836$_2$
Mean of 1 deposit, electrolyte, alkaline, added $5/10^6$ NaOH	58
Mean of 1 deposit, electrolyte, alkaline, added $10/10^6$ NaOH	75
Mean of 4 deposits	1.01851$_8$

6. Electrolyte Slightly Acid, HNO_3 *added*

Mean of 1 deposit, electrolyte acid, added $10/10^6$ HNO_3	1.01820$_0$
Mean of 2 deposits, electrolyte acid, added $100/10^6$ HNO_3	16$_0$
Mean of 3 deposits	1.01817$_3$

Summary

Mean of 22 experiments, group 1 equals	1.01828_6
Mean of 13 experiments, group 3 equals	1.01828_6
Mean of 35 experiments, group 4 equals	1.01833_3
Mean of 70, giving each equal weight, equals	1.01831_0
Mean of 70, giving group 4 half weight, equals	1.01830_2

There was a difference of opinion among the delegates as to how the results should be weighted in taking the mean, but for the purpose of fixing the value of the Weston Normal Cell to five figures it fortunately makes little difference how the results are combined. If equal weight is given to all, the result is nearly the same as though the weights were unequal.

The results showed that voltameters in which filter paper is used as septum lead to results which are too high. The delegates were therefore unanimously of the opinion that the results of experiments made under these conditions should not be used for the determination of the value of the emf of the Weston Normal Cell.

The committee were of the unanimous opinion that "the mean of the results which they have obtained will not be modified by more than several parts in one hundred thousand when the specifications shall have been completed.

"The committee decides to recommend to the International Committee for Electrical Units and Standards the following value for the emf of the Weston Normal Cell:

E = 1.0183 international volts at 20°C."

The delegates were unable in the light of the data at hand to agree on final specifications for the voltameter. No time was available for considering specifications for the standard cell.

The work done clearly established the importance of employing exceedingly pure silver nitrate for the voltameter and the need for suitable tests of purity, as very slight percentages of certain impurities considerably affected the amount of deposit obtained.

Further work has been in progress in two of the laboratories since the Washington meeting and it is hoped that at an early date, specifications for the voltameter can be agreed upon. There will then remain to be considered similar specifications for the standard cell.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

METEOROLOGY.—*The temperature at Mount Weather, Va. and adjacent valley stations.* ALFRED J. HENRY. Mount Weather Bulletin **4**: 310–341. 1911.

The simultaneous mountain and valley temperatures as obtained by automatic registers are reported upon in some detail. It is shown that the variations of temperature between the mountain top and the valley below are not wholly dependent upon slope and topography but vary to a great extent with the weather conditions.

Attention is also directed to the temperature changes in the free air above Mount Weather from hour to hour and from day to day, as disclosed by kite flights. The belief is expressed that the temperature of the free air is largely controlled, at least up to the 3 kilometer level, by horizontal air currents in the strata near the earth's surface. A. J. H.

BOTANY.—*Agricultural varieties of the cowpea and immediately related species.* C. V. PIPER. Bulletin, 229. Bureau Plant Industry. 1912.

This bulletin presents the results of an extended study of the varieties of *Vigna sinensis*, *Vigna catjang* and *Vigna sesquipedalis*, which are treated for convenience, as three separate species, but which integrade fully and all hybridize.

In the course of the study of these varieties, extending over eight years, about one thousand lots of seed have been grown; 370 from foreign sources and the remainder form the United States. As a result of these studies, 35 varieties of Asparagus bean, 50 of Catjang and 220 of Cowpeas were found to be distinct varieties in an agronomic sense, and descriptive notes concerning them are given. As all of these can be hybridized, the number of varieties obtainable is practically limitless, or in other words, "Practically every combination of seed, color and shape, with habit and life period can be obtained."

In habit the three species vary from prefectly prostrate to perfectly erect, five types being recognized for purposes of description, namely, prostrate; procumbent; low, half bushy; tall, half bushy; and treelike or erect. The last two types are considered most valuable from an agricultural standpoint. In general, Asparagus beans produce slender vines, prostrate or procumbent without support, while the Catjung and Cowpea possess all the types of habit.

Natural hybrids are rare in the United States, but they have been found at Madison, Indiana, and at North Lansing, Michigan. In the agricultural literature there is much confusion due to the fact that there are many more varieties than has been generally recognized, and also to the fact that seed color alone had been accepted as a criterion of the variety. Of the numerous named varieties it is possible now to identify satisfactorily very few, excepting those of which pedigreed or otherwise authentic seed is available. In the main the names have been preserved only in a traditional way by seedsmen. The characteristics most important in the cowpea, considered mainly as a forage crop, are outlined and the most valuable varieties to use in breeding are indicated. C. V. P.

ZOOLOGY.—*The northern elephant seal,* Macrorhinus angustirostris Gill. CHAS. HASKINS TOWNSEND, Director of the New York Aquarium. Zoologica No. 8, pp. 159–73, figs. 52–72. April 15, 1912.

This is the second publication of the scientific results of the expedition to the Gulf of California, in charge of C. H. Townsend, by the U. S. Fisheries Steamship *Albatross* in 1911, published by permission of the U. S. Commisssion of Fisheries in Zoologica (Scientific Contributions of the New York Zoological Society).

The author gives an account of the rediscovery of a species long on the verge of extinction. He refers to the extensive slaughter of the elephant seal for its oil about sixty years ago and its subsequent occurrence at rare intervals in Lower California.

The *Albatross* expedition found about 150 of the animals at Guadalupe Island, off the coast of Lower California, and procured specimens and photographs illustrating the great size of the adult male, its remarkable proboscis and its manner of fighting. The food and breeding habits of the animals are also considered.

The following points are noted: The northern species is unquestionably distinct from the southern elephant seal of the Antarctic islands

(*Macrorhinus leoninus*). It now breeds only at Guadalupe Island, and there are about 150 of the animals in existance. The trunk, or proboscis, of the adult male is not capable of inflation, but is retracted into heavy folds on top of the head by muscular action. The breeding season begins a few days before March 1 and the period of gestation is 12 months. The color of the young at birth is black. The yearling utters a call or scream unlike the voice of any other seal. In captivity its favorite food is fish. The yearling and two-year-old have a peculiar habit of lifting the head and hind flippers above the back until they nearly meet.

One important statement is to the effect that the Mexican authorities have already taken steps to prevent further killing of this species.

W. E. SAFFORD.

PHYSIOLOGY.—*Sound as a directing influence in the movements of fishes.* G. H. PARKER. Bulletin of the Bureau of Fisheries, **30**: 97–104. 1910. Issued April 27, 1912.

Pursuing his researches upon the sense of hearing in fishes, Dr. Parker has found that different species of fish differ not only in sensitiveness to sound but respond by movements of different directive character. With a tank of special construction which concealed from the fish all outside surroundings, and a pendulun which delivered regular blows upon one end of the tank, eight species were tested in numbers of five individuals each, their movements being carefully noted for fifty blows upon each end of the tank.

The fishes fell into three classes as follows: (1) Those which tended to retreat from the region of sound production; illustrated by the tautog (*Tautog onitis*), the scup (*Stenotomus chrysops*), young kingfish (*Menticirrhus saxatilis*), and young swellfish (*Spheroides maculatus*). (2) Those which were attracted by the sound, as the sea robins (*Prionotus carolinus* and *P. strigatus*). (3) Those which, though agitated, moved neither toward nor away from the sound; illustrated by the killifishes (*Fundulus heteroclitus* and *F. majalis*). Of all three classes it was observed that the influence of the sound was almost as short in duration as the stimulus. It is therefore improbable that sounds of brief duration can have much effect on the temporary distribution of fishes within their reach. That fishes should be attracted over any considerable area or repelled from that area by sound would seem to demand some more or less continuous source of sound production.

ETHEL M. SMITH.

ANTHROPOLOGY.—*Censers and incense of Mexico and Central America.* WALTER HOUGH. Proceedings U. S. Natural Museum, **42**: 109–137. Apri 17, 1912.

The paper is a study of ancient and modern censers and presents a classification of these interesting objects into communal censers, which are stationary, and special censers, which are classed as portable, gesture and swinging censers. It also discusses the use of incense in worship, the origin of incense materials, and the customs connected with the use of incense. The paper is illustrated with twelve plates and twelve text figures. W. H.

PHYSICAL ANTHROPOLOGY.—*The natives of Kharga Oasis, Egypt.* ALES HRDLICKA. Smithsonian Miscellaneous collect ons, **59**: no. 1. 1912.

This work is the result of the coöperation of the Smithsonian Institution with the Metropolitan Museum of New York. It presents geographical and historical notes on the Great Oasis and the recent data on the Kharga Oasis people. The writer has gathered numerous general observations and information on environment, social and medical records, vital statistics, physiological observations on the body and a large number of measurements on the people. This valuable and comprehensive study contains a bibliography and appendix of detailed measurements and is illustrated with thirty-eight plates and twelve figures. Dr. Hrdlicka concludes:

The type of the Kharga natives is radically distinct from that of the negro. It is according to all indications fundamentally the same as that of the non-negroid Valley Egyptians. It is in all probability a composite of closely related northeastern African and Southwestern Asiatic, or "hamitic" and "semitic" ethnic elements, and is to be classed with these as part of the southern extension of the Mediterranean subdivision of the white race.

Judging from the mummies of the Oasis inhabitants from the 2–5 centuries A. D., exhumed at El Baguat, the type of the present non-negroid Kharga natives is substantially the same as that of the population of the Oasis during the first part of the Christian era. The nature of the population of the Oasis in more ancient times can only be determined by skeletal material from the ancient cemetries.

W. HOUGH.

REFERENCES

METEOROLOGY.—Monthly Weather Review. **39**: No. 4, pp. 487–648, charts 8; No. 5, pp. 649–813, charts 7; No. 6, pp. 815–971, charts 7; No. 7, pp. 973–1134, charts 7; No. 8, pp. 1135–1300, charts 7; No. 9, pp. 1301–1466, charts 7; No. 10, pp. 1467–1631, charts 7; No. 11, pp. 1633–1790, charts 8.

TECHNOLOGY.—Technological papers of the Bureau of Standards: (1) *Effect of preliminary heat treatment upon the drying of clays*, A. V. BLEININGER; (2) *The strength of reinforced concrete beams*—results of tests of 333 beams (First Series), R. L. HUMPHREY and L. H. LOSSE; (3) *Tests of the absorptive and permeable properties of Portland cement mortars and concretes, together with tests of damp-proofing and water-proofing compounds and materials*, R. J. WIG and P. H. BATES; (4) *The effect of added fatty and other oils upon the carbonization of mineral lubricating oils*, C. W. WATERS; (5) *The effect of high pressure steam on the crushing strength of Portland cement mortar and concrete*, R. J. WIG; (6) *The determination of chromium, and its separation from vanadium, in steels*, J. R. CAIN; (7) *The testing of clay refractories, with special reference to their load carrying ability at furnace temperatures*, A. V. BLEININGER and G. H. BROWN; (8) *A rapid method for the determination of vanadium in steels, ores, etc., based on its quantitative inclusion by the phospho-molybdate precipitate*, J. R. CAIN and J. C. HOSTETTER; (9) *The density and thermal expansion of linseed oil and turpentine*, H. W. BEARCE.

TECHNOLOGY.—Reports issued by the Bureau of Mines:

Coals available for the manufacture of illuminating gas. A. H. WHITE and PERRY BARKER. Bulletin 6, pp. 77. 1911. Results of experiments with 6 typical coals. Gives analyses of the coals and the percentages of gas, ammoniacal liquor, etc., obtained by distilling in a standard horizontal retort.

Résumé of producer-gas investigations, October 31, 1904, to June 30, 1910. R. H. FERNALD and C. D. SMITH. Bulletin 13, pp. 393. 1911. A detailed account of results obtained in gas-producer tests made by the United States Geological Survey. Gives analyses of producer gas from different classes of coals. Discusses the chemical reactions involved in the gasification of fuel in a producer and the factors that affect the economical operation of a gas-producer plant.

Investigation of the explosives used in coal mining, with a chapter on the natural gas used at Pittsburgh. CLARENCE HALL, W. O. SNELLING, S. P. HOWELL and G. A. BURRELL. Bulletin 15, pp. 197. 1912. Discusses the nature, composition and thermochemistry of explosives, with particular reference to permissible explosives. Among the subjects considered are the thermochemistry of carbon dioxide and carbon monoxide, the formation of carbon dioxide and carbon monoxide in the presence of water, the maximum temperature of explosion of various explosive substances; the specific heats of solid substances at high temperatures; practical methods of reducing the flame temperatures of explosives; and tables of use in thermochemical calculations.

The bulletin contains an account of an investigation of the natural gas used in the tests of explosives by the Bureau of Mines with the methods used in the exact determination of the constituents of this gas and the bearing of the results on the use of the gas in testing the relative safety of explosives. The bulletin also contains a description of apparatus and methods used by the bureau for physical tests of explosives and gives results of tests with permissible explosives, dynamite, black powder and 4 permitted explosives.

The uses of peat for fuel and other purposes. C. A. DAVIS. Bulletin 16, pp. 214. 1911. Contains a discussion of the distribution of peat in the United States, the climatic and surface conditions that govern the accumulation of peat beds, the various types of plants that contribute to peat deposits; also discusses the physical and chemical properties of peat in relation to its fuel value, and the methods of utilizing peat for fuel both in this country and in Europe. The bulletin also contains a review of the other uses of peat, proximate and ultimate analyses and calorific value of a large number of samples of peat from different States, and a selected bibliography of the more important publications on the uses of peat.

A primer on explosives for coal miners. C. E. MUNROE and CLARENCE HALL. Bulletin 17, pp. 70. 1911. This bulletin is a revised reprint of U. S. Geological Survey Bulletin 423. Among the subjects treated are combustion and explosion, the composition of explosives, igniting devices, and the proper methods of storing and using explosives.

Physical and chemical properties of the petroleums of the San Joaquin Valley of California, with a chapter on analyses of natural gas from the oil fields of Southern California. I. C. ALLEN and W. A. JACOBS and G. A. BURRILL. Bulletin 19, pp. 60. 1911. Gives a brief description of the methods used in examining a large number of samples of petroleum from the Kern River, Coalinga, McKittrick, Midway, and Sunset oil fields; a tabular statement of the results of the examination and a detailed description of an electric still designed for the exact fractionation of petroleums in the laboratory. Also contains a brief description of the methods used in determining the constituents of natural gas.

Alaskan coal problems. W. L. FISHER. Bulletin 36, pp. 32. 1911. Briefly summarizes the salient economic features of the Matanuska and Bering River coal fields, and discusses the probable markets for the coal and the advantages and disadvantages of having the coal mined under government leases.

Specifications for the purchase of oil by the government, with directions for sampling oil and natural gas. I. C. ALLEN. Technical Paper 3, pp. 13. 1911. Contains specifications based on physical properties and heating value, and gives the methods used by representatives of the Bureau of Mines in sampling petroleum or fuel oil and in sampling natural gas.

The electrical section of the Bureau of Mines, its purpose and equipment. H. H. CLARK. Technical Paper 4, pp. 12. 1911. Gives a brief statement of the purposes for which electricity is used in mines and the dangers from electrical equipment; mentions the equipment of the electrical laboratory of the Bureau of Mines experiment station at Pittsburgh, Pa., and summarizes briefly the results of an investigation of the safety of enclosed cartridge fuses.

The rate of burning of fuse as influenced by temperature and pressure. W. O. SNELLING and W. C. COPE. Technical Paper 6, pp. 28. 1912. The results of a careful investigation of the influence of pressure, temperature, moisture and mechanical injury on the rate of burning of ordinary blasting fuse, with attention to the bearing of the results on the use of explosives in mines.

Investigations of fuse and miners' squibs. CLARENCE HALL and S. P. HOWELL. Technical Paper 7, pp. 19. 1912. Among the subjects investigated were the characteristics of different brands of miners' fuse, the quantity of powder used per foot in miners' fuse, the size of the powder grains, the gases produced by combustion, and the relative safety and efficiency of fuse for use in mines.

Methods of analyzing coal and coke. F. M. STANTON and A. C. FIELDNER. Technical Paper 8, pp. 21. 1912. Gives in detail the analytical methods used in the Pittsburgh laboratory of the Bureau of Mines for analyzing samples of coal and coke and determining their heating value. The methods are essentially those recommended by the American Chemical Society, with modifications that have been found desirable.

Liquefied products from natural gas, their properties and uses. I. C. ALLEN and G. A. BURRELL. Technical Paper 10, pp. 23. 1912. Briefly discusses early attempts at liquefying natural gas; describes experiments made by the authors; gives analyses of those types of natural gas yielding the largest proportion of liquefied products; and discusses the properties and industrial uses of these products.

ECONOMIC GEOLOGY.—*Contributions to economic geology* (short papers and preliminary reports) 1909: Part II, *Mineral Fuels.* MARIUS R. CAMPBELL. Bulletin U. S. Geological Survey No. 431. Pp. 254, maps and sections. 1911. This volume comprises the following articles: *Natural gas in North Dakota,* A. G. LEONARD; *The San Juan oil field, San Juan,* Utah, H. E. GREGORY; *Gas and oil prospects near Vale, Oreg., and Payette, Idaho,* C. W. WASHBURNE: *Gas prospects in Harney Valley, Oreg.,* C. W. WASHBURNE; *Preliminary report on the geology and the oil prospects of the Cantua-Panoche region, California,* ROBERT ANDERSON; *The southern part of the Cahaba coal field, Alabama,* CHARLES BUTTS; *The Powell Mountain coal field, Scott and Wise counties, Va.,* M. R. CAMPBELL and E. G. WOODRUFF; *The eastern part of the Bull Mountain coal field, Montana,* C. T. LUPTON; *Preliminary report of the Coos Bay coal field, Oregon,* J. S. DILLER and M. A. PISHEL; *The Black Mesa coal field, Arizona,* M. R. CAMPBELL and H. E. GREGORY; *Coal Deposits near Pinedalle, Navajo Country, Ariz.,* A. C. VEATCH; *Coal in San Benito County, Cal.,* M. R. CAMPBELL.